

In the Claims:

1. (Currently Amended) An electrochemical sensing device wherein analyte-selective organic materials are suspended over a cavity penetrating alternating submicroelectrode layers and insulating layers, analyte selective organic materials being suspended such that they do not come in contact with the submicroelectrodes.

2. (Currently amended) A microcavity device comprising:

(a) a flexible polymer substrate;

(b) integrated, independently addressable electrodes, wherein one of the electrodes is a disk electrode on the substrate and covering the bottom of the microcavity and not used as a reference electrode;

(c) conducting layers connected to said electrodes, said conducting layers being planar and parallel to one another and comprising contact pads;

(d) an insulating layer separating adjacent conducting layers;

(e) said conducting layers and insulating layer being on top of said substrate; and,

(f) at least one microcavity penetrating said conducting layers and said insulating layer, said microcavity having a depth, a diameter and a top opening.

3. (Original) The microcavity device of claim 2 wherein a thin film membrane covers said top opening.

4. (Original) The microcavity device of claim 3 wherein said membrane selectively permits mass transfer across said membrane.

1 5. (Original) The microcavity device of claim 3 wherein said membrane permits selective mass
2 transfer of an analyte into said microcavity, selectively permits mass transfer of an analyte from said
3 microcavity, and selectively prevents mass transfer of substances which are not analytes into said
4 microcavity.

1 6. (Original) The microcavity device of claim 2 wherein said height of said microcavity is less than
2 1 millimeter.

1 7. (Original) The microcavity device of claim 2 wherein said diameter of said microcavity is less
2 than 1 millimeter.

1 8. (Original) The microcavity device of claim 2 wherein said electrodes are selected from a group
2 consisting of band electrodes and disk electrodes.

1 9. (Original) The microcavity device of claim 2 wherein there are at least two electrodes.

1 10. (Original) The microcavity device of claim 2 wherein a volume of said microcavity is between
2 one femtoliter and one picoliter.

1 11. (Original) The microcavity device of claim 2, wherein said device includes a plurality of
2 microcavities forming a multiple well array.

1 12. (Original) The microcavity device as recited in claim 11, wherein said array includes at least
2 96 wells.

1 13. (Original) The microcavity device of claim 2, wherein said microcavity device provides at least
2 one electrochemical cell.

1 14. (Original) The microcavity device of claim 2, wherein said device is a recessed disk
2 microelectrode.

1 15. (Currently amended) A microcavity device comprising:

2 (a) a silicon wafer substrate;

3 (b) integrated, independently addressable electrodes, wherein one of the electrodes is a
4 microdisk electrode on the substrate and covering the bottom of the microcavity and not used as a
5 reference electrode;

6 (c) conducting layers connected to said electrodes, said conducting layers being planar
7 and parallel to one another and comprising contact pads;

8 (d) an insulating layer separating adjacent conducting layers;

9 (e) said conducting layers and insulating layer being on top of said substrate; and,

10 (f) at least one microcavity penetrating said conducting layers and said insulating layer,
11 said microcavity having a depth, a diameter and a top opening.

1 16. (Currently amended) A microcavity chemical sensing device, comprising:

2 (a) a flexible polymer substrate:

3 (b) integrated, independently addressable electrodes;

4 (c) conducting layers connected to said electrodes, said conducting layers being planar
5 and parallel to one another and comprising contact pads, wherein one of the electrodes is a microdisk
6 electrode on the substrate and covering the bottom of the microcavity and not used as a reference
7 electrode;

8 (d) an insulating layer to separate said conducting layers;

9 (e) said conducting layers and insulating layer being on top of said substrate;

10 (f) a microcavity penetrating said conducting layers and said insulating layer, said
11 microcavity having a depth, a diameter and a top opening;

12 (g) wherein said microcavity device is a self-contained electrochemical cell ; and

13 (h) a device for measuring electrical potential differences or current between electrodes.

1 17. (Original) The microcavity device as recited in claim 16, further comprising:

2 (i) a thin film membrane covering said top opening.

1 18. (Original) The microcavity device of claim 17 wherein said membrane permits selective mass
2 transfer of an analyte into said microcavity, selectively permits mass transfer of an analyte from said
3 microcavity, and selectively prevents mass transfer of substances which are not analytes into said
4 microcavity.

1 19. (Original) The microcavity device of claim 16 wherein said depth of said microcavity is less
2 than one millimeter.

1 20. (Original) The microcavity device of claim 16 wherein said diameter of said microcavity is less
2 than one millimeter.

1 21. (Original) The microcavity device of claim 16 wherein said electrodes are selected from a group
2 consisting of band electrodes and disk electrodes.

1 22. (Original) The microcavity device of claim 16 wherein there are at least two electrodes.

1 23. (Original) The microcavity device of claim 16 wherein the volume of said microcavity is
2 between one femtoliter and one picoliter.

1 24. (Original) The microcavity device of claim 16 wherein said device includes a plurality of micro-
2 cavities forming a multiple well array.

1 25. (Original) The microcavity device of claim 24 wherein said array includes at least 96 wells.

1 26. (Original) The microcavity device of claim 16 wherein said device is a recessed disk
2 microelectrode.

1 27. (Currently amended) A microcavity chemical sensing device, comprising:

2 (a) a silicon wafer substrate:

3 (b) integrated, independently addressable electrodes, wherein one of the electrodes is a
4 microdisk electrode on the substrate and covering the bottom of the microcavity and not used as a

5 reference electrode;

6 (c) conducting layers connected to said electrodes, said conducting layers being planar
7 and parallel to one another and comprising contact pads;

8 (d) an insulating layer to separate said conducting layers;

9 (e) said conducting layers and insulating layer being on top of said substrate;

10 (f) a microcavity penetrating said conducting layers and said insulating layer, said
11 microcavity having a depth, a diameter and a top opening;

12 (g) wherein said microcavity device is a self-contained electrochemical cell ; and

13 (h) a device for measuring electrical potential differences or current between electrodes.

1 28. (Currently amended) A microfabricated recessed disk microelectrode, comprising:

2 (a) a substrate;

3 (b) integrated, independently addressable disk and band electrodes;

4 (c) conducting layers connected to said electrodes, said conducting layers being planar
5 and parallel to one another and comprising contact pads;

6 (d) an insulating layer to separate said conducting layers;

7 (e) said conducting layers and insulating layer[s] being on top of said substrate;

8 (f) a microcavity penetrating said conducting layers and said insulating layer[s], said
9 microcavity having a depth, a bottom and a diameter; and,

10 (g) wherein said disk electrode is recessed from the main plane of an insulating layer of
11 the substrate ~~such that it is flush with the bottom of the insulating layer and covers the entire bottom~~
12 of said microcavity and is not used as a reference electrode.

1 29. (Canceled) A recessed disk microelectrode, comprising:

- 2 (a) a silicon dioxide film grown on a silicon wafer by thermal oxidation;
- 3 (b) positive photoresist spin-coated onto said silicon wafer;
- 4 (c) a photolithographic mask through which said silicon wafer is exposed to ultraviolet
- 5 light;
- 6 (d) contact leads and microdisk electrodes developed by said photoresist;
- 7 (e) a chromium film adhesion layer deposited on said photoresist by thermal evaporation;
- 8 (f) said wafer being sonicated in acetone to dissolve the photoresist and to cause lift-off
- 9 of a metal on top of said wafer;
- 10 (g) said wafer being spin-coated wafer with polyimide;
- 11 (h) said polyimide being polymerized by exposure to ultraviolet light and cured to cross-
- 12 link to a polymer thereby formed;
- 13 (i) a second chromium layer and a second gold layer deposited on top of said polyimide
- 14 by thermal evaporation;
- 15 (j) a pattern formed by exposing said photoresist to ultraviolet light through a second
- 16 photolithographic mask;
- 17 (l) a covering of gold and chromium which covers electrode lines, with an area over an
- 18 end of said lines left open for contact; and
- 19 (m) a hole formed through said second layer of gold and chromium, and through said
- 20 polyimide layer to expose said first layer of gold and chromium.

1 30. (Canceled) The recessed disk microelectrode of claim 29 wherein said silicon dioxide film is
2 two micrometers thick.

1 31. (Canceled) The recessed disk micro electrode of claim 29 wherein said recessed disk
2 microelectrode further comprises two individually addressable microelectrodes.

1 32. (Currently amended) A microcavity device for detecting amino acids, comprising:

2 (a) a silicon wafer to act as a substrate for the microcavity device;

3 (b) conductor layers;

4 (c) electrodes connected to said conductor layers, wherein one of the electrodes is a
5 microdisk electrode on the substrate and covering the bottom of the microcavity and not used as a
6 reference electrode;

7 (d) a polyimide insulating layer to separate said conductor layers; and

8 (e) a microcavity penetrating at least one electrode and at least one insulating layer,
9 wherein said conductor layers and said electrodes are made of at least one of gold and copper.

1 33. (Original) The microcavity device of claim 32 wherein a thin film membrane covers said
2 microcavity.

1 34. (Original) The microcavity device of claim 33 wherein said membrane permits selective mass
2 transfer of an analyte into said microcavity, selectively permits mass transfer of an analyte from said
3 microcavity, and selectively prevents mass transfer of substances which are not analytes into said
4 microcavity.

1 35. (Original) The microcavity device of claim 32 wherein said microcavity further comprises a
2 depth and a diameter and wherein said depth of said microcavity is less than one millimeter.

1 36. (Original) The microcavity device of claim 35 wherein said diameter of said microcavity is less
2 than one millimeter.

1 37. (Original) The microcavity device of claim 32 wherein said electrodes are selected from a group
2 consisting of band electrodes and disk electrodes.

1 38. (Original) The microcavity device of claim 32 wherein there are at least two electrodes.

1 39. (Original) The microcavity device of claim 32 wherein the volume of said microcavity is
2 between one femtoliter and one picoliter.

1 40. (Original) The microcavity device of claim 32 wherein said device includes a plurality of micro-
2 cavities forming a multiple well array.

1 41. (Original) The microcavity device of claim 40 wherein said array includes at least 96 wells.

1 42. (Original) The microcavity device of claim 32 wherein said microcavity device provides at least
2 one electrochemical cell.

1 43. (Original) The microcavity device of claim 32 wherein said device is a recessed disk micro-
2 electrode.

1 44. (Canceled) An electrode structure wherein exposed surfaces of insulating layers are modified
2 by attachment of chlorosilanes that contain hydroxyl moieties to provide further polar environment
3 on an interior side of the cavity for enhancing bilayer deposition.

1 45. (Canceled) A structure for three-dimensional microfabricated devices wherein edges of bilayer
2 are anchored by alkanethiol-derivatives attached to the inner edges of Au layers in an etched region
3 of insulator and wherein a bottom of the device is lined with an insulator layer.

1 46. (New) The device in Claim 2 further comprising adhesion layers between the insulating and
2 conducting layers and the conducting layer and the substrate.

1 47. (New) The device in Claim 15 further comprising adhesion layers between the insulating and
2 conducting layers and the conducting layer and the substrate.

1 48. (New) The device in Claim 16 further comprising adhesion layers between the insulating and
2 conducting layers and the conducting layer and the substrate.

1 49. (New) The device in Claim 27 further comprising adhesion layers between the insulating and
2 conducting layers and the conducting layer and the substrate.

1 50. (New) The device in Claim 28 further comprising adhesion layers between the insulating and
2 conducting layers and the conducting layer and the substrate.